

43.
Difficulties
of the vortex
ring theory.

of Lord Kelvin this theory led to the conception that in an all-pervading, boundless fluid, such as physicists imagined for the purposes of the theory of light, differentiated portions might exist in the form of whirling rings (vortex rings), which would possess most of the properties of ponderable matter—identity and permanence of quantity of substance, stability, rigidity, elasticity. It was indeed soon found that although eminently suggestive in this way, and pointing in the direction of a general kinetic theory of natural phenomena, the vortex ring theory presented two fundamental difficulties. How does whirling matter acquire weight, and how does it acquire immensely increased inertia? In the explanation of these two properties the progress has been small,—if indeed any glimpse at all has as yet been got.¹ But by suggesting numberless experiments through which our knowledge of things natural has been enormously increased, by placing, before the minds of mathematicians a great number of problems of practical importance and physical interest, and generally by familiarising the minds of philosophers with an ultimate kinetic explanation of nature,² the vortex-atom theory has marked an epoch in

after him, to distinguish between singly, doubly, triply, &c., connected surfaces ('Werke,' 1876, pp. 18, 88, 448). These studies, which for a long time were looked upon merely as *curiosa* or of purely abstract interest, were independently taken up in the practical interest of the vortex-atom theory by Prof. Tait in 1876 ("On Knots," Trans. Roy. Soc. Edinb., 1877, vol. 28, p. 145, &c.), and continued in 1884-85. To him we owe a convenient notation and vocabulary. For the history of the subject and

further developments, see Dingledey, 'Topologische Studien,' Leipzig, 1890.

¹ See Clerk Maxwell's article "Atom" in the 9th ed. of the 'Ency. Brit.,' reprinted in 'Scientific Papers,' vol. ii., and the account given there of Le Sage's theory.

² See Dr Larmor's Address to Section A of the Brit. Assoc. at Bradford in 1890 (Report, p. 625): "The vortex-atom theory has been a main source of physical suggestion, because it presents, on a simple basis, a dynamical picture of an